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G06F 1/30

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GB 2147437 A GB 0256815 A

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(54) Internal card type uninterruptible power system

(57) An internal card type uninterruptible power system 7 is to be used in combination with a computer 2 that is normally operated by line power. The system 7 includes a battery pack 9 which is charged when the line power is available and which is actuated to supply power to the computer 2 when the line power is cut off. The computer 2 is set to the real memory mode if it was operating in the virtual memory mode before the line power was cut off, and is then controlled so as to store system variables and memory data in a magnetic disk. The battery pack 9 is deactivated after storage of system variables and data has been completed. When the line power is restored, the computer 2 is controlled so as to retrieve the system variables and data from the magnetic disk and thereby restore the computer 2 to the previous operating state.

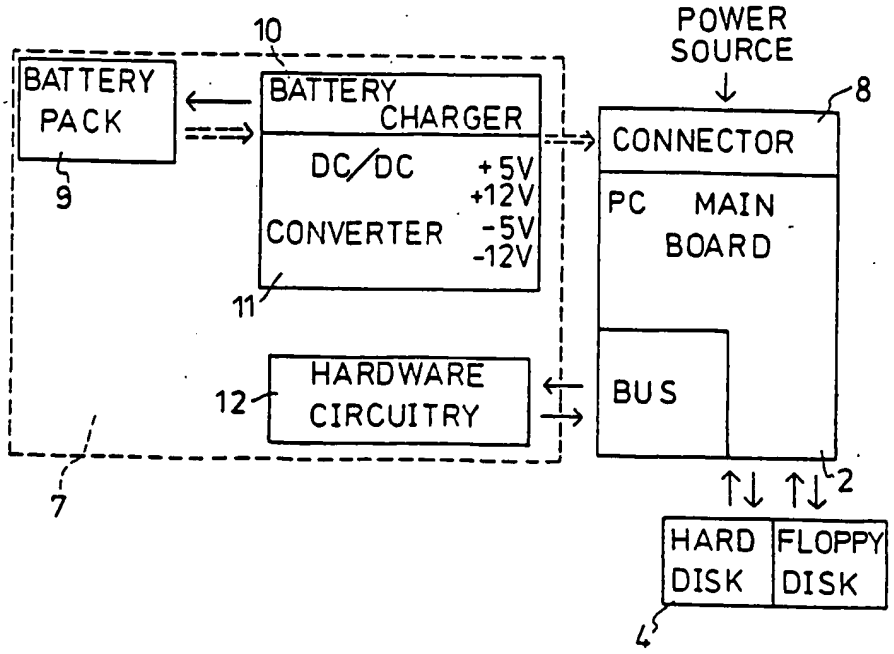
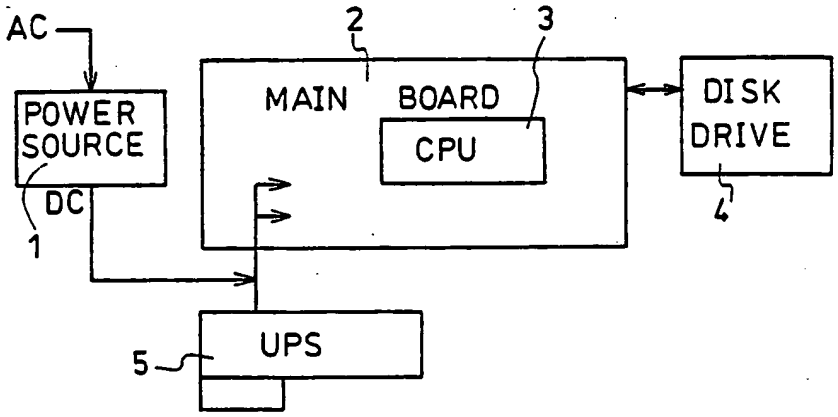


FIG. 2

GB 2 262 170 A



PRIOR ART
FIG.1

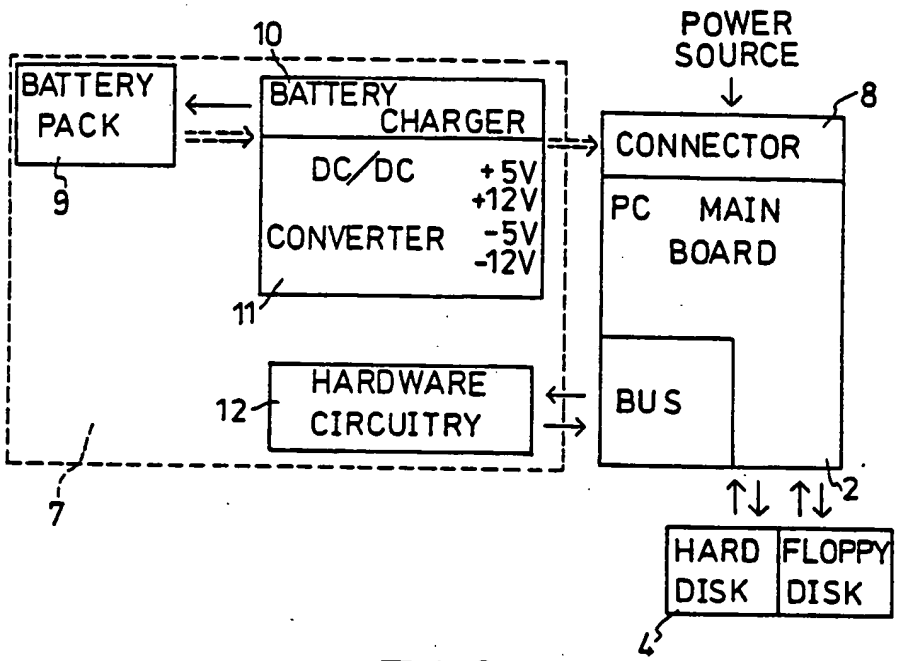

10
POWER
SOURCE
BATTERY
PACK
BATTERY
CHARGER
8
CONNECTOR
DC/DC
+5V
+12V
-5V
-12V
CONVERTER
PC MAIN
BOARD
9
11
HARDWARE
CIRCUITRY
12
BUS
7
2
HARD
DISK
FLOPPY
DISK
4

FIG. 2

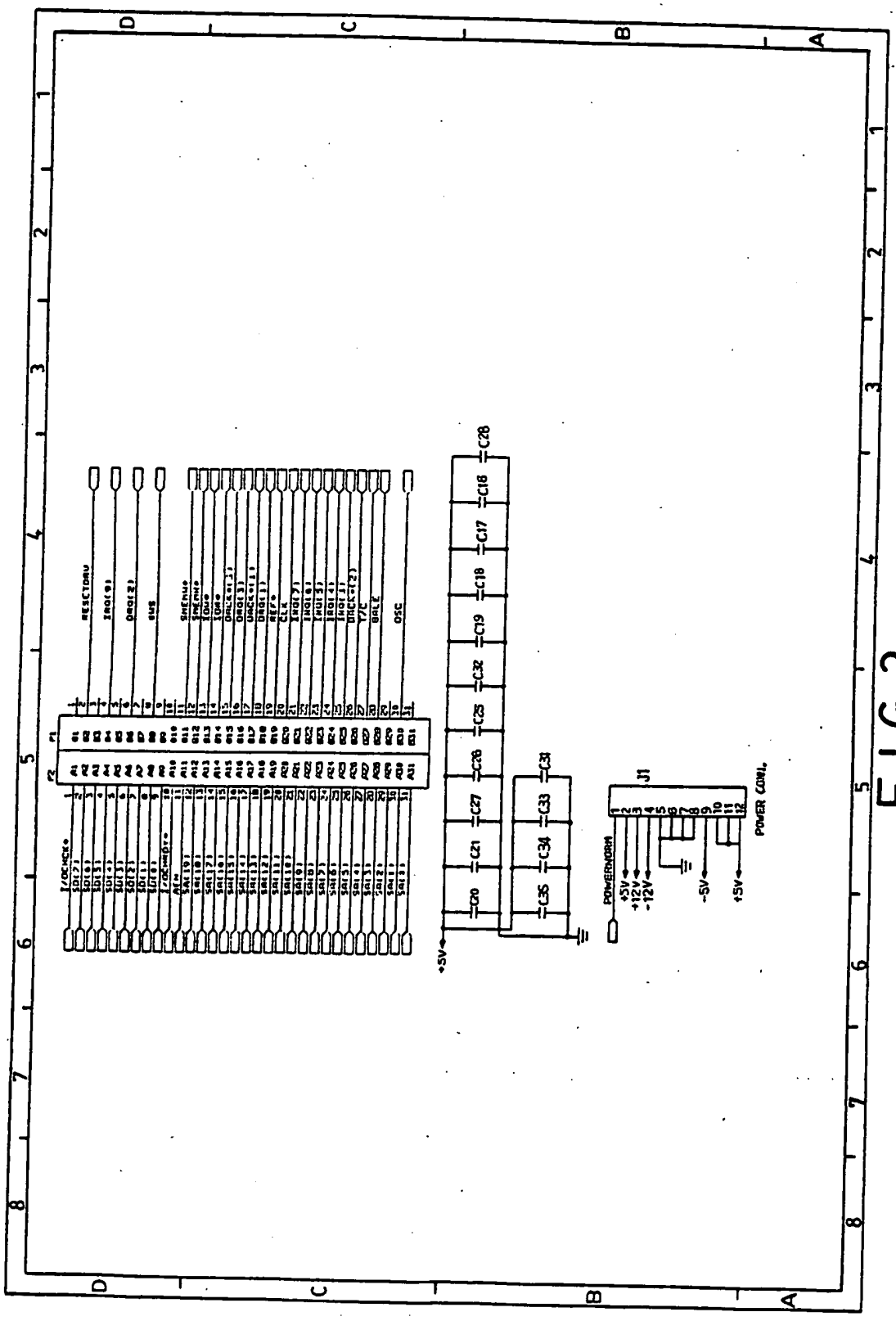

P1
P2
J1
POWER CONN.
POWERNORM
+5V
+12V
-12V
-5V
+5V
C20
C21
C27
C26
C25
C32
C19
C18
C17
C28
C35
C34
C33
C31
RESETDRV
OSC

FIG. 3

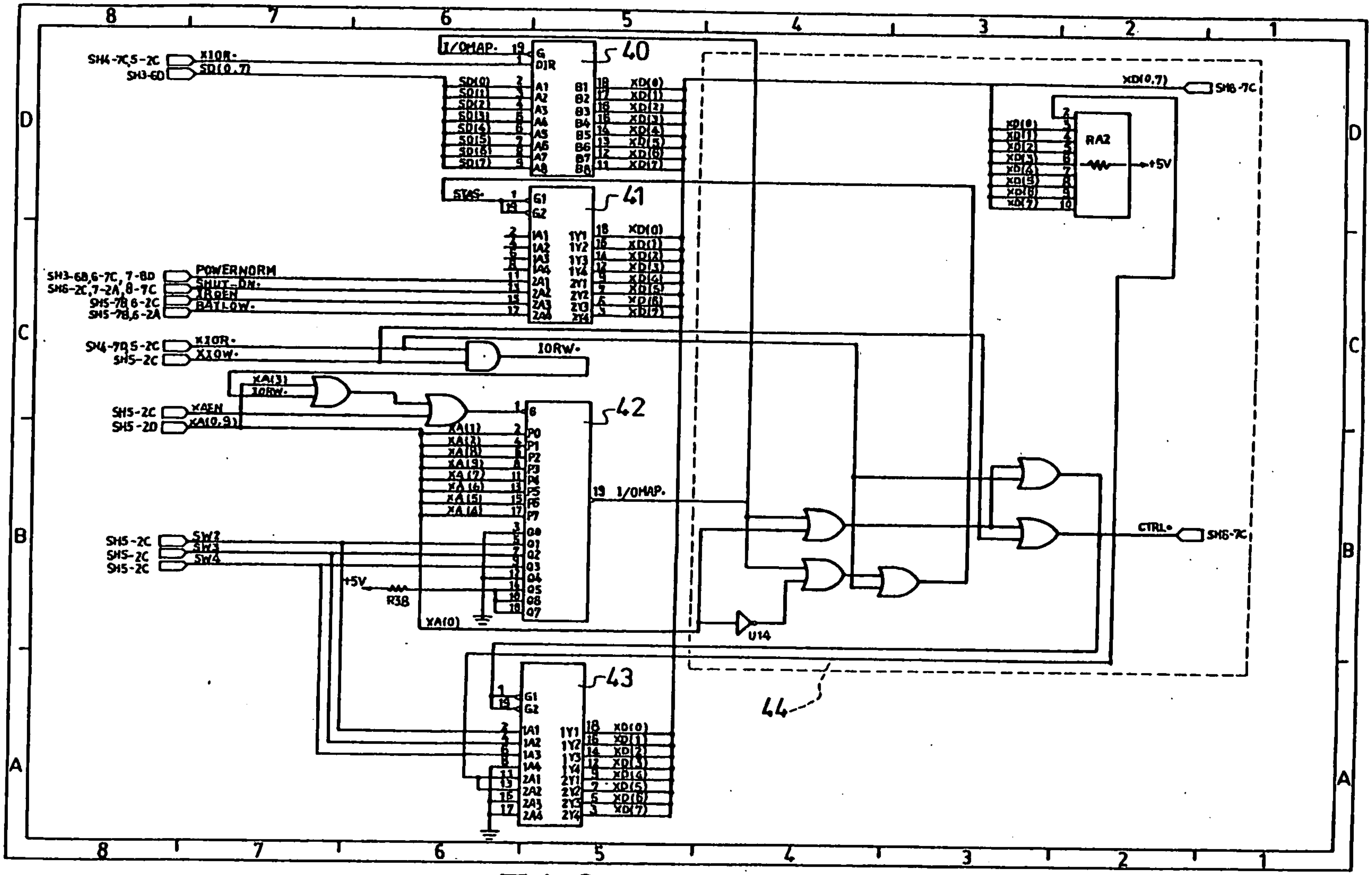

40
41
42
43
44
RA2
+5V
R38
U14
I/OMAP.
STAS.
IORW.
CTRL.
XD(0,7)
SH6-7C
SH4-7C,5-2C
SH3-6D
XIOR.
SD(0,7)
POWERNORM
SHUT-DN.
IRGEN
BATLOW.
SH3-6B,6-7C, 7-8D
SH6-2C,7-2A,8-7C
SH5-7B,6-2C
SH5-7B,6-2A
SH4-7D,5-2C
SH5-2C
XIOR.
XIOW.
XAEN
XA(0,9)
SH5-2D
XA(3)
IORW.
SW2
SW3
SW4
XA(0)

FIG. 4

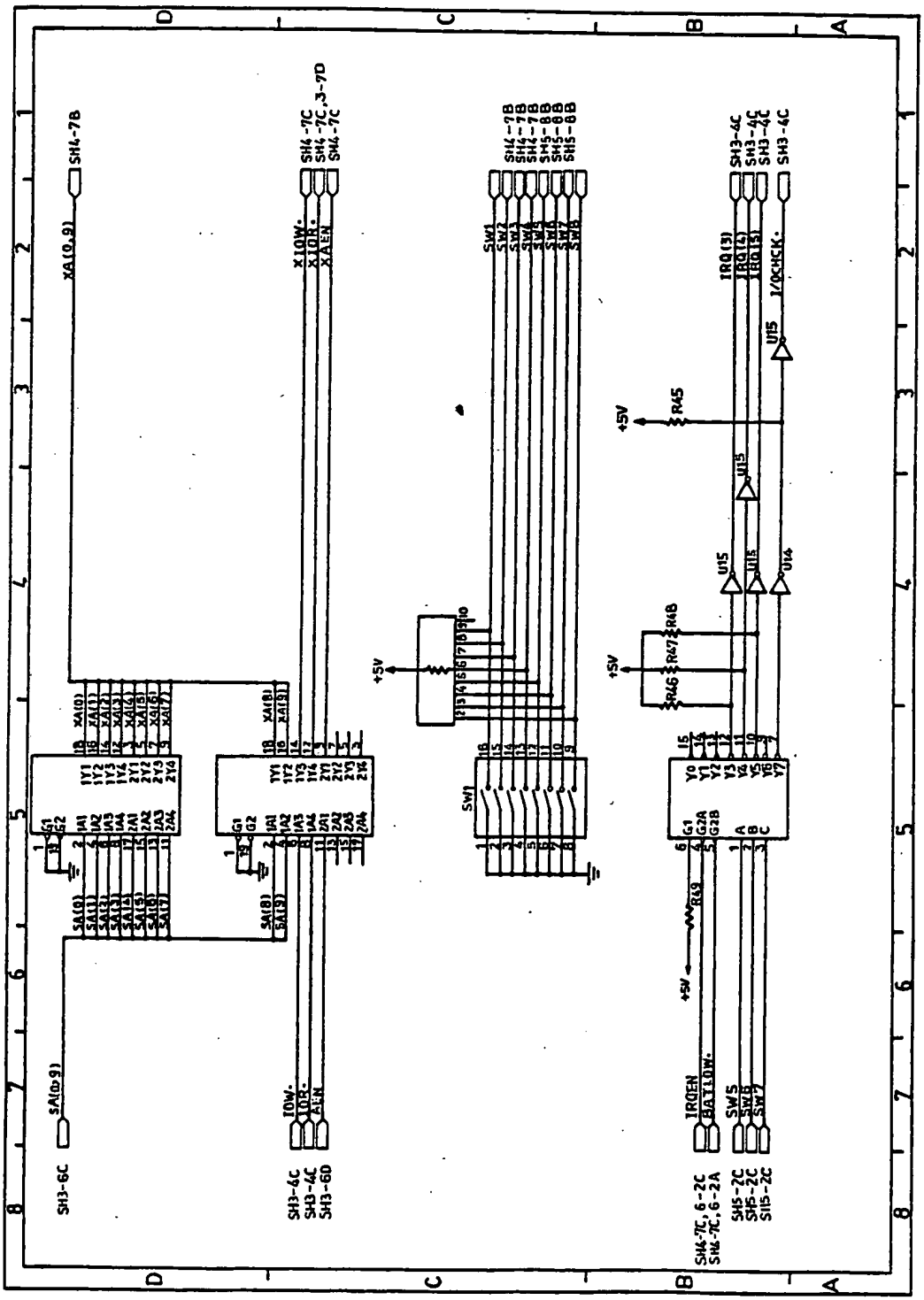

SH4-7B
XA(0.9)
SH4-7C
SH4-7C,3-7D
SH4-7C
X10W-
XA10R-
XAEN
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SH4-7B
SH4-7B
SH4-8B
SH5-8B
SH5-8B
SH3-4C
SH3-4C
SH3-4C
IRQ(3)
IRQ(4)
IRQ(5)
I/OCHCK-
U15
U14
+5V
R45
R46
R47
R48
R49
SA(0.9)
SH3-6C
IOW-
IOR-
AEN
SH3-4C
SH3-4C
SH3-6D
IRQEN
BATLOW-
SW5
SW6
SW7
SH4-7C, 6-2C
SH4-7C, 6-2A
SH5-2C
SH5-2C
SH15-2C

FIG. 5

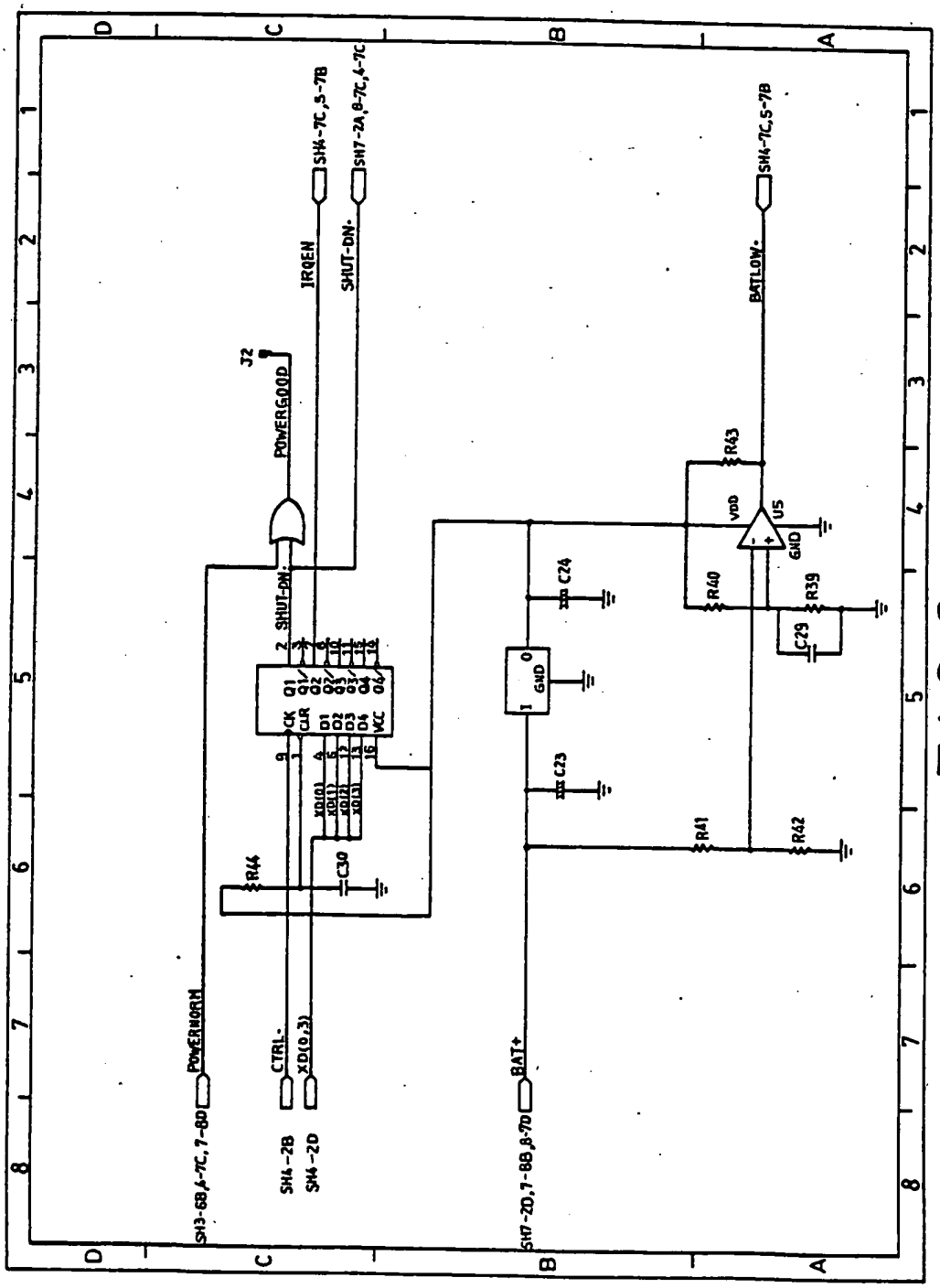

SH4-7C,5-7B
SH4-7C,5-7B
SH7-2A,8-7C,4-7C
IRQEN
SHUT-DN-
BATLOW-
J2
POWERGOOD
R43
VDD
U5
GND
R40
R39
C29
C24
C23
R41
R42
SHUT-DN-
CK
CLR
Q1
Q2
Q3
Q4
Q5
Q6
D1
D2
D3
D4
VCC
XD(0)
XD(1)
XD(2)
XD(3)
R44
C30
POWERWORM
CTRL-
XD(0:3)
SH4-2B
SH4-2D
SH3-6B,4-7C,7-8D
BAT+
SH7-2D,7-8B,8-7D

FIG. 6

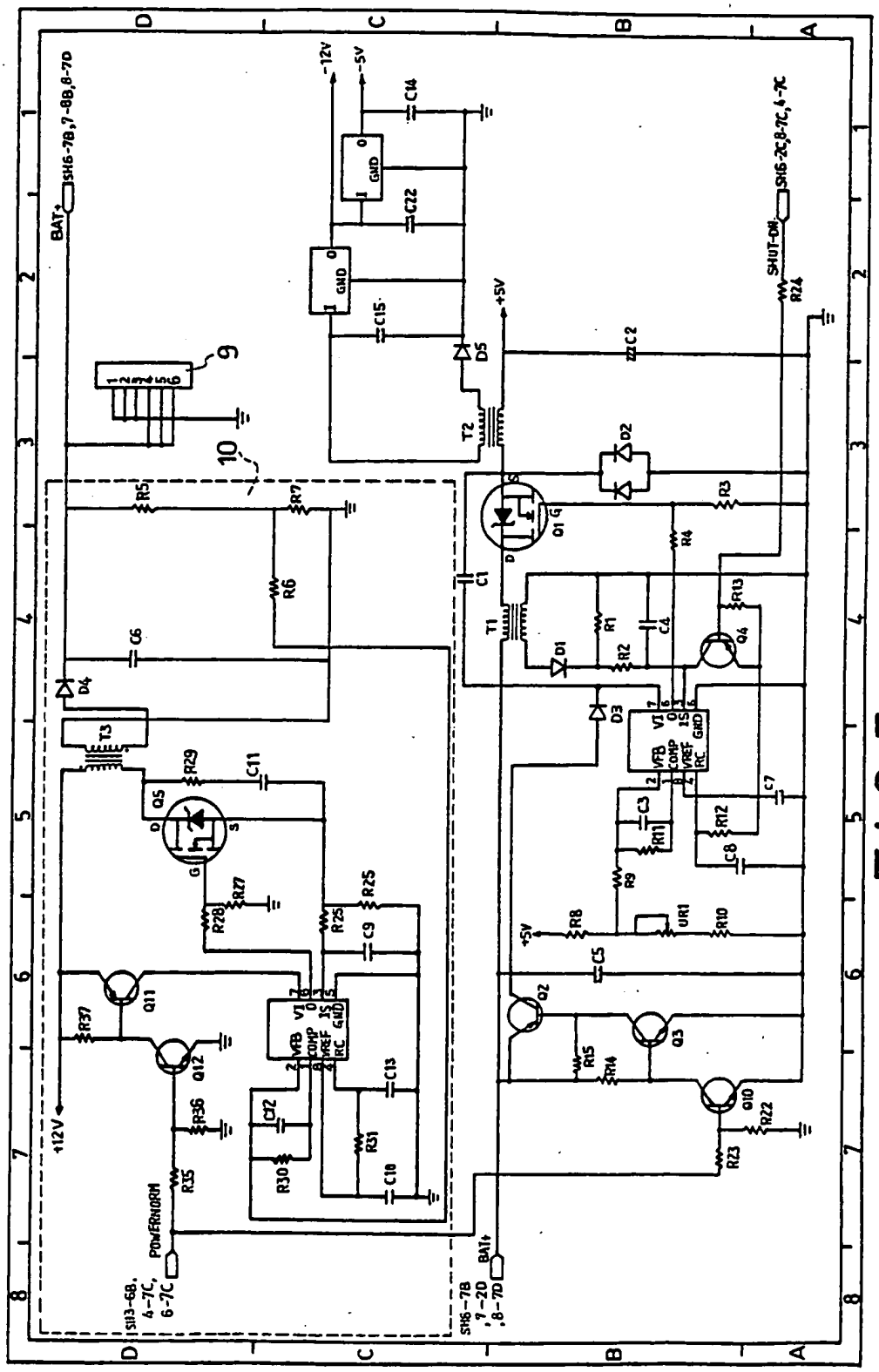

BAT+
SH16-7B,7-8B,8-7D
SH16-2C,8-7C,4-7C
SHUT-DN
R24
-12V
-5V
+5V
C14
C12
C15
D5
T2
D2
Q1
R3
R4
C1
T1
D1
R1
R2
C4
R13
Q4
D3
C6
D4
T3
R5
R7
R6
9
10
R29
C11
Q5
R27
R28
R25
C9
Q11
Q12
R37
R36
R35
R30
C12
R31
C10
C13
+12V
POWERNORM
SH13-6B,4-7C,6-7C
SH16-7B,7-2D,8-7D
BAT+
C7
C3
R11
R12
C8
R9
R8
VR1
R10
C5
Q2
Q3
R15
R14
Q10
R22
R23
VFB
COMP
VREF
RC
GND
IS

FIG. 7

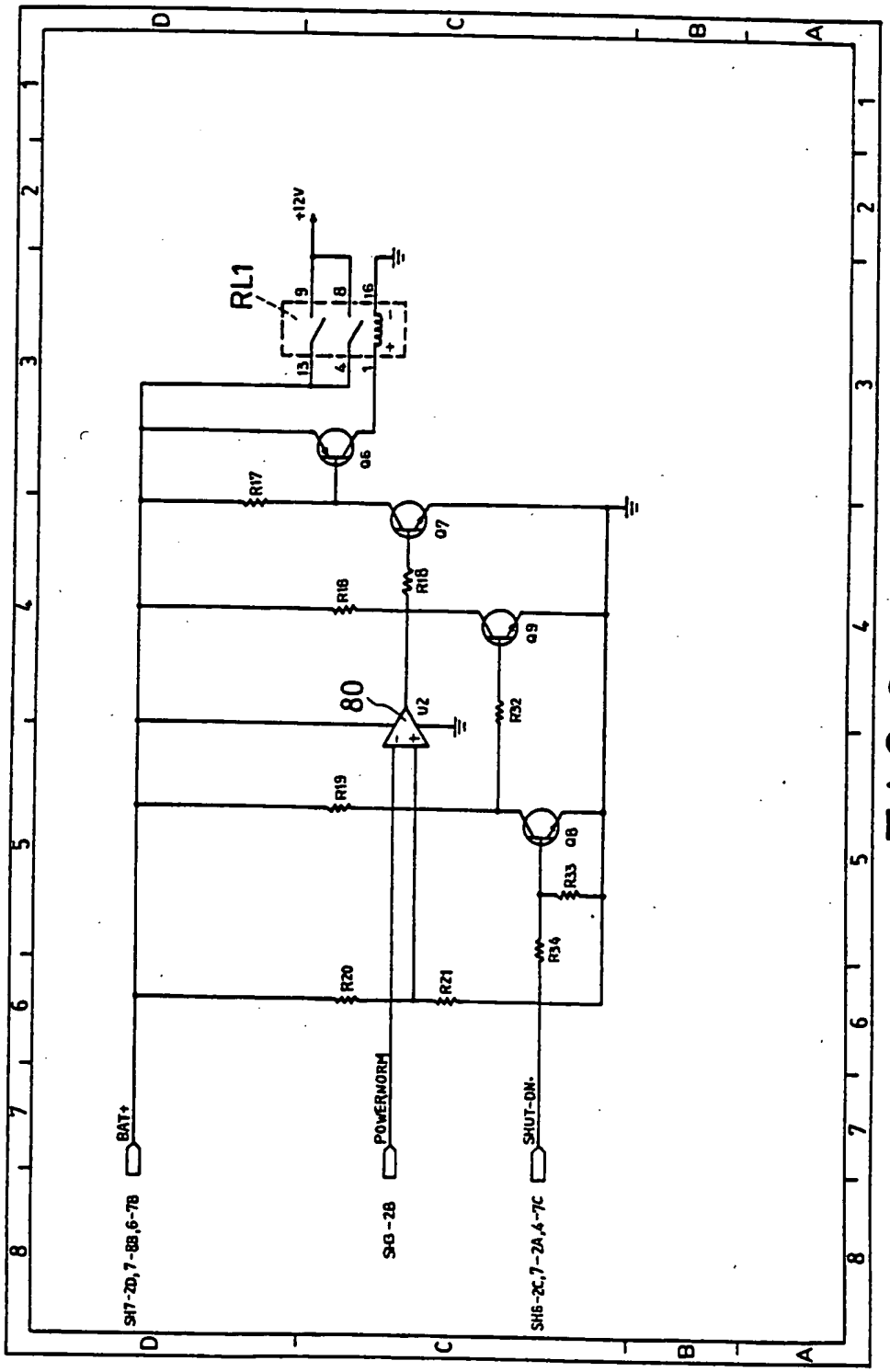

+12V
RL1
19
18
16
13
4
1
Q6
R17
Q7
R16
R18
Q9
80
U2
R32
R19
Q8
R33
R34
R20
R21
BAT+
POWERNORM
SHUT-DN
SH7-2D,7-8B,6-7B
SH6-2C,7-2A,4-7C

FIG.8

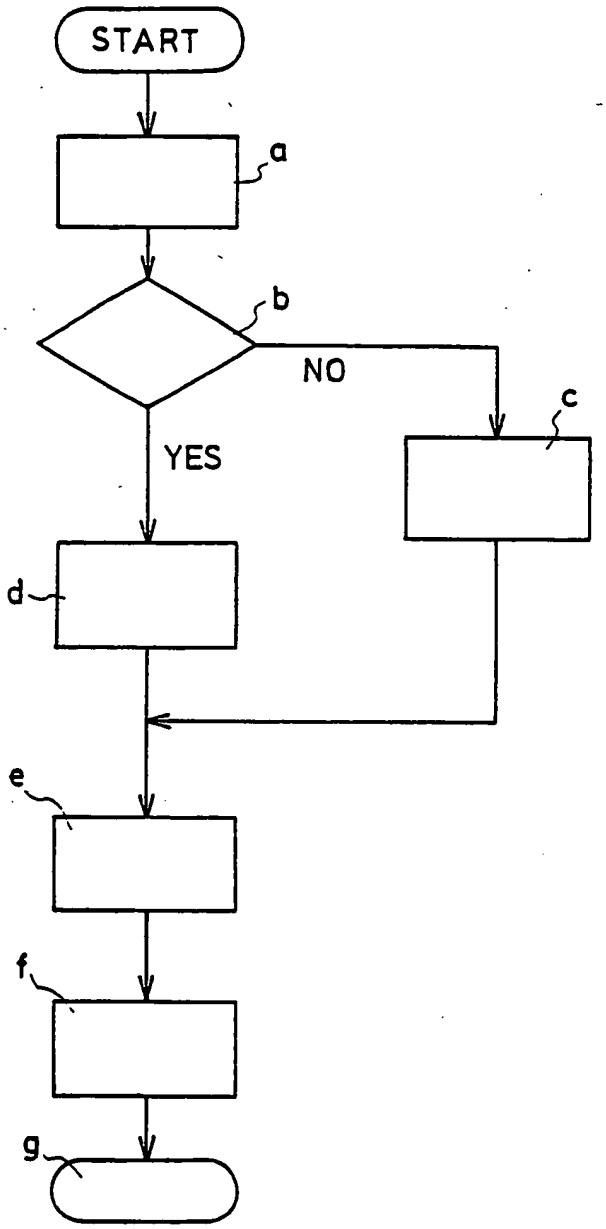


FIG. 9

INTERNAL CARD TYPE UNINTERRUPTIBLE POWER SYSTEM

This invention relates to an internal card type uninterruptible power system (UPS), more particularly to an internal card type UPS which can ensure that no data will be lost should power interruption occur when the central processing unit (such as the 80386) is operating in the virtual memory mode.

Figure 1 is a schematic block diagram of a conventional internal card type smart UPS when used with an IBM PC/AT system. A power source (1) can convert AC line voltage into a DC voltage. A main board (2) has a central processing unit (3) provided thereon. A disk drive (4) and the internal card type smart UPS (5) are connected to the main board (2).

The operation of the above disclosed UPS card is as follows: The UPS supplies back-up electric power to the operating system when power interruption occurs. The system variables and data in the memory unit are then automatically stored on a magnetic disk. When power is restored, the system variables and data are retrieved from the magnetic disk and the operating system is restored to its previous operating state (the state before power interruption occurred).

The above procedure can be readily executed when the system is operating in the real memory mode because data can be easily stored and retrieved from any one of the system data sources and because the system does not

require any additional protective measures when it is operating in the real memory mode.

However, execution of the above procedure becomes complicated when the system is operating in the virtual memory mode. There are several commands in the central processing unit which cannot be executed, and there are some special internal registers which cannot be accessed. Therefore, when the system is operating in the virtual memory mode, it is impossible to store the internal states of the central processing unit completely and access all of the available memory space. Thus, when power interruption occurs, it is also impossible to store all of the system variables and data on a magnetic disk.

For example, the system is operating in the virtual memory mode when the Windows 3.0 software (developed by Microsoft Corporation) is in use. The resident driver routines and a conventional software are under the control of the windows system and cannot be directly accessed from any of the system data sources. Thus, when power interruption occurs and when the real memory mode method is used to store the system variables and data, the work of the windows system is ruined, and the system cannot be restored to its previous operating state.

Therefore, the main objective of the present invention is to provide an internal card type

uninterruptible power system (UPS) which can ensure that no data will be lost should power interruption occur when the system is operating in the virtual memory mode.

Accordingly, the preferred embodiment of an internal card type uninterruptible power system is to be used in combination with a computer that is normally operated by line power and comprises: a battery pack; a battery charger means for charging the battery pack when the line power is available; means for actuating the battery pack to supply power to the computer when the line power is cut off; means for generating an interrupt command to the computer when the line power is cut off; means for setting the computer to the real memory mode if the computer was operating in the virtual memory mode before the line power was cut off; a first control means for controlling the computer to store system variables and memory data on the magnetic disk storage means; means for deactivating the battery pack after storage of system variables and data has been completed; and a second control means for controlling the computer to retrieve system variables and data from the magnetic disk storage means so as to restore the computer to the previous operating state when the line power is restored.

Other features and advantages of the present invention will become apparent in the following

detailed description of the preferred embodiment with reference to the accompanying drawings, of which:

Figure 1 is a block diagram of a conventional UPS card when used with an IBM PC/AT system;

Figure 2 is a block diagram of the preferred embodiment of an internal card type UPS according to the present invention;

Figure 3 is a pin diagram of the preferred embodiment as shown in Figure 2;

Figure 4 is a schematic circuit diagram of a first circuit portion of the preferred embodiment used for converting the system from the virtual memory mode to the real memory mode;

Figure 5 is a schematic circuit diagram of a second circuit portion of the preferred embodiment;

Figure 6 is a schematic circuit diagram of a third circuit portion of the preferred embodiment used for initiating the execution of resident driver routines;

Figure 7 is a schematic circuit diagram illustrating a battery charger of the preferred embodiment;

Figure 8 is a schematic circuit diagram of another circuit portion for detecting power interruption; and

Figure 9 is a flowchart of a data storage procedure which is conducted by the preferred embodiment.

Referring to the block diagram shown in Figure 2, the preferred embodiment of an internal card type UPS (7) according to the present invention is connected to

a conventional computer main board (2) via a P8, P9 connector (8). The UPS card (7) comprises a battery pack (9), a battery charger (10), a DC/DC converter (11) and associated hardware circuitry (12).

The operation of the UPS card (7) is as follows:

(1) Referring to Figure 2 and to the upper half of Figure 7, when line power is available, a POWERNORM signal is supplied to the main board (2) via the P8, P9 connector (8). The battery charger (10) charges the battery pack (9) at this time.

(2) Referring to Figure 8, when the line power is cut off, a low voltage signal is detected at the negative input terminal of a comparator (80). The output to the positive input terminal of the comparator (80) is a high voltage signal, and thus, a positive voltage signal is generated at the output terminal of the comparator (80). The positive voltage signal causes the transistors (Q6, Q7) to conduct and actuate a relay (RL1). The normally open contacts of the relay (RL1) close so as to permit the system to draw electric power from the battery pack (9). The voltage output of the battery pack (9) is supplied to the DC/DC converter (11) so as to generate four stable DC voltages: +5 V, +12 V, -5 V, and -12 V. Generation of the +5 V, -5 V and -12 V voltages can be found in the lower half of Figure 7. The +12 V voltage can be obtained from the output of the circuit shown in Figure 8.

(3) Referring to the upper half of Figure 6, when the line power is cut off, a POWERGOOD signal is at a low logic state, thereby generating an Interrupt signal to the computer main board (2) to initiate the execution of the resident driver routines. Upon detection that the line power was cut off, the resident driver routines set up preparations for storing data. The time which elapsed since the line power was cut off is first counted. If the line power was restored within a predetermined time period, the data storage procedure is terminated. Therefore, continuous operation of the system is ensured in the event of relatively short power outages.

The data storage procedure is immediately executed when the line power is not restored within the predetermined time period. A flowchart of the data storage procedure can be found in Figure 9. The resident driver routines start to set request storage flags [step (a)]. The control port (6) of the UPS card (7) is then read to determine if the system is operating in the real memory mode [step (b)]. If the system is operating in the real memory mode, no special protective measures are needed, and step (d) is then executed. If the system is operating in the virtual memory mode, operation of the central processing unit (not shown) of the computer main board (2) is interrupted, and the storage driving routine for the

virtual memory mode is executed [step (c)]. The central processing unit is set from the virtual memory mode to the real memory mode before the storage of system data begins.

When storing of system data is initiated, the request storage flags are first inspected to see whether or not they have been reset [step (d)]. This indicates that the line power has been restored and that the system can be restored to its previous operating state. If the request storage flags are not reset after a predetermined time period, the system storage operation is initiated [step (e)]. The request storage flags are reset during the execution of step (e). Afterwards, the system variables and data are stored on a magnetic disk [step (f)]. The DC power source of the UPS card (7) is then shut off, thereby stopping the operation of the system. This permits conservation of the stored energy of the battery pack (9) in preparation for another power outage.

The system variables and data are stored on a magnetic disk. When the line power is restored, data in the magnetic disk is retrieved to restore the system to the previous operating state (that is, the state before the line power was cut off].

(4) In step (b) of the flowchart shown in Figure 9, it is necessary to distinguish if the system is operating in the real memory mode or in the virtual

memory mode. If the system is in the virtual memory mode, a converter circuit is necessary to convert the system from the virtual memory mode to the real memory mode.

It has been found that Address (170) of the central processing unit is used to indicate if the system is operating in the virtual memory mode or in the real memory mode. The content of Address (170) is 1 [170#1] if the system is in the virtual memory mode, and is 2 [170#2] if the system is in the real memory mode.

When power interruption occurs, the system may be in the real memory mode or in the virtual memory mode. Referring to Figure 4, four buffer means (40, 41, 42, 43) are connected to a comparator means (44). The circuit shown in Figure 4 is not in operation should power interruption occur when the system is in the real memory mode. When the system is in the virtual memory mode, the signal [170#1] from the central processing unit is received by the comparator means (44), and the signal [170#2] is sent to the central processing unit to convert the system from a virtual memory mode to the real memory mode. Thus, when power interruption occurs, the entire system variables and data can be safely stored even when the system is originally in the virtual memory mode.

There are many methods available to interrupt the operation of the central processing unit. Aside from

the use of the I/O port, the use of "INT" commands or a RAM method can also be used to achieve the interrupt action. However, if the I/O port method is not used, conflict in the data sources can occur and thus affect the operation of the system. Conversion from the virtual memory mode to the real memory mode, however, can be easily and safely accomplished when the I/O port is used to generate the interrupt signal.

The following are other visible differences between the UPS card (7) of the present invention and conventional UPS cards:

1. The preferred embodiment is thinner and lighter and requires only a single AT bus slot. This is in contrast with conventional UPS cards which require 2-3 bus slots.

2. The DC/DC converter of the preferred embodiment has a conversion efficiency which is greater than 90%. This is in contrast with those of conventional UPS cards whose DC/DC conversion efficiency range from 50%-70%.

3. The AT bus interface circuit utilizes no memory chips (that is, only logic gates and flip-flops are used). Conversion from the virtual 86 memory mode can be easily executed so as to ensure proper data storage in the event of power interruption.

CLAIMS:

1. An internal card type uninterruptible power system to be used in combination with a computer that is normally operated by line power, said computer having a magnetic disk storage means and said uninterruptible power system comprising:

a battery pack;

a battery charger means for charging said battery pack when the line power is available;

means for actuating said battery pack to supply power to said computer when the line power is cut off;

means for generating an interrupt command to said computer when the line power is cut off;

means for setting said computer to the real memory mode if said computer is operating in the virtual memory mode before the line power was cut off;

a first control means for controlling said computer to store system variables and memory data in said magnetic disk storage means;

means for deactivating said battery pack after storage of system variables and data has been completed; and

a second control means for controlling said computer to retrieve system variables and data from said magnetic disk storage means so as to restore said computer to the previous operating state when the line power is restored.

2. The internal card type uninterruptible power system as claimed in claim 1, further comprising means for activating said first control means only when the line power is not restored within a predetermined time period.

3. The internal card type uninterruptible power system as substantially described hereinbefore with reference to the accompanying Figures 2-9.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9125898.8

Relevant Technical fields

(i) UK Cl (Edition K) G4A (AEP)

(ii) Int Cl (Edition 5) G06F - 1/30

Search Examiner

B G WESTERN

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search

3 MARCH 1992

Documents considered relevant following a search in respect of claims 1-3

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2147437 A Coppola (see whole document)	1-3
A	GB 0256815 A2 Universal Vectors (see whole document)	1-3

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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